

Figure 2.16 Some common monatomic ions of the elements. Main-group elements usually form a single monatomic ion. Note that members of a group have ions with the same charge. [Hydrogen is shown as both the cation H^+ in Group 1A(1) and the anion H^- in Group 7A(17).] Many transition elements form two different monatomic ions. (Although Hg_2^{2+} is a diatomic ion, it is included for comparison with Hg^{2+} .)

Period

	1A (1)	2A (2)	3B (3)	4B (4)	5B (5)	6B (6)	7B (7)	8B (8) (9) (10)	1B (11)	2B (12)	3A (13)	4A (14)	5A (15)	6A (16)	7A (17)	8A (18)
1	H^+														H^-	
2	Li^+												N^{3-}	O^{2-}	F^-	
3	Na^+	Mg^{2+}									Al^{3+}			S^{2-}	Cl^-	
4	K^+	Ca^{2+}				Cr^{2+} Cr^{3+}	Mn^{2+}	Fe^{2+} Fe^{3+}	Co^{2+} Co^{3+}	Cu^+ Cu^{2+}	Zn^{2+}				Br^-	
5	Rb^+	Sr^{2+}								Ag^+	Cd^{2+}	Sn^{2+} Sn^{4+}			I^-	
6	Cs^+	Ba^{2+}								Hg_2^{2+} Hg^{2+}		Pb^{2+} Pb^{4+}				
7																

Figure 2.16 Some common monatomic ions of the elements.

Main-group elements usually form a single monatomic ion. Note that members of a group have ions with the same charge. [Hydrogen is shown as both the cation H⁺ in Group 1A(1) and the anion H⁻ in Group 7A(17).] Many transition elements form two different monatomic ions. (Although Hg₂²⁺ is a diatomic ion, it is included for comparison with Hg²⁺.)

Electron configuration in PT

Period number: highest occupied energy level

Figure 8.5 A periodic table of partial ground-state electron configurations. These ground-state electron configurations show the electrons beyond the previous noble gas in the sublevel block being filled (excluding filled inner sublevels). For main-group elements, the group heading identifies the general outer configuration. Anomalous electron configurations occur often among the *d*-block and *f*-block elements, with the first two appearing for Cr (*Z* = 24) and Cu (*Z* = 29). Helium is colored as an *s*-block element but placed with the other members of Group 8A(18). Configurations for elements 110 to 112, 114, and 116 have not yet been confirmed.

Main-Group Elements (<i>s</i> block)			Transition Elements (<i>d</i> block)										Main-Group Elements (<i>p</i> block)					
	1A (1) <i>ns</i> ¹																	8A (18) <i>ns</i> ² <i>np</i> ⁶
1	1 H <i>1s</i> ¹	2A (2) <i>ns</i> ²											3A (13) <i>ns</i> ² <i>np</i> ¹	4A (14) <i>ns</i> ² <i>np</i> ²	5A (15) <i>ns</i> ² <i>np</i> ³	6A (16) <i>ns</i> ² <i>np</i> ⁴	7A (17) <i>ns</i> ² <i>np</i> ⁵	2 He <i>1s</i> ²
2	3 Li <i>2s</i> ¹	4 Be <i>2s</i> ²											5 B <i>2s</i> ² <i>2p</i> ¹	6 C <i>2s</i> ² <i>2p</i> ²	7 N <i>2s</i> ² <i>2p</i> ³	8 O <i>2s</i> ² <i>2p</i> ⁴	9 F <i>2s</i> ² <i>2p</i> ⁵	10 Ne <i>2s</i> ² <i>2p</i> ⁶
3	11 Na <i>3s</i> ¹	12 Mg <i>3s</i> ²	3B (3)	4B (4)	5B (5)	6B (6)	7B (7)	8B (8) (9) (10)			1B (11)	2B (12)	13 Al <i>3s</i> ² <i>3p</i> ¹	14 Si <i>3s</i> ² <i>3p</i> ²	15 P <i>3s</i> ² <i>3p</i> ³	16 S <i>3s</i> ² <i>3p</i> ⁴	17 Cl <i>3s</i> ² <i>3p</i> ⁵	18 Ar <i>3s</i> ² <i>3p</i> ⁶
4	19 K <i>4s</i> ¹	20 Ca <i>4s</i> ²	21 Sc <i>4s</i> ² <i>3d</i> ¹	22 Ti <i>4s</i> ² <i>3d</i> ²	23 V <i>4s</i> ² <i>3d</i> ³	24 Cr <i>4s</i> ¹ <i>3d</i> ⁵	25 Mn <i>4s</i> ² <i>3d</i> ⁵	26 Fe <i>4s</i> ² <i>3d</i> ⁶	27 Co <i>4s</i> ² <i>3d</i> ⁷	28 Ni <i>4s</i> ¹ <i>3d</i> ⁸	29 Cu <i>4s</i> ¹ <i>3d</i> ¹⁰	30 Zn <i>4s</i> ² <i>3d</i> ¹⁰	31 Ga <i>4s</i> ² <i>4p</i> ¹	32 Ge <i>4s</i> ² <i>4p</i> ²	33 As <i>4s</i> ² <i>4p</i> ³	34 Se <i>4s</i> ² <i>4p</i> ⁴	35 Br <i>4s</i> ² <i>4p</i> ⁵	36 Kr <i>4s</i> ² <i>4p</i> ⁶
5	37 Rb <i>5s</i> ¹	38 Sr <i>5s</i> ²	39 Y <i>5s</i> ² <i>4d</i> ¹	40 Zr <i>5s</i> ² <i>4d</i> ²	41 Nb <i>5s</i> ¹ <i>4d</i> ⁴	42 Mo <i>5s</i> ¹ <i>4d</i> ⁵	43 Tc <i>5s</i> ² <i>4d</i> ⁵	44 Ru <i>5s</i> ¹ <i>4d</i> ⁷	45 Rh <i>5s</i> ¹ <i>4d</i> ⁸	46 Pd <i>4d</i> ¹⁰	47 Ag <i>5s</i> ¹ <i>4d</i> ¹⁰	48 Cd <i>5s</i> ² <i>4d</i> ¹⁰	49 In <i>5s</i> ² <i>5p</i> ¹	50 Sn <i>5s</i> ² <i>5p</i> ²	51 Sb <i>5s</i> ² <i>5p</i> ³	52 Te <i>5s</i> ² <i>5p</i> ⁴	53 I <i>5s</i> ² <i>5p</i> ⁵	54 Xe <i>5s</i> ² <i>5p</i> ⁶
6	55 Cs <i>6s</i> ¹	56 Ba <i>6s</i> ²	57 La* <i>6s</i> ² <i>5d</i> ¹	72 Hf <i>6s</i> ² <i>5d</i> ²	73 Ta <i>6s</i> ² <i>5d</i> ³	74 W <i>6s</i> ² <i>5d</i> ⁴	75 Re <i>6s</i> ² <i>5d</i> ⁵	76 Os <i>6s</i> ² <i>5d</i> ⁶	77 Ir <i>6s</i> ² <i>5d</i> ⁷	78 Pt <i>6s</i> ¹ <i>5d</i> ⁹	79 Au <i>6s</i> ¹ <i>5d</i> ¹⁰	80 Hg <i>6s</i> ² <i>5d</i> ¹⁰	81 Tl <i>6s</i> ² <i>6p</i> ¹	82 Pb <i>6s</i> ² <i>6p</i> ²	83 Bi <i>6s</i> ² <i>6p</i> ³	84 Po <i>6s</i> ² <i>6p</i> ⁴	85 At <i>6s</i> ² <i>6p</i> ⁵	86 Rn <i>6s</i> ² <i>6p</i> ⁶
7	87 Fr <i>7s</i> ¹	88 Ra <i>7s</i> ²	89 Ac** <i>7s</i> ² <i>6d</i> ¹	104 Rf <i>7s</i> ² <i>6d</i> ²	105 Db <i>7s</i> ² <i>6d</i> ³	106 Sg <i>7s</i> ² <i>6d</i> ⁴	107 Bh <i>7s</i> ² <i>6d</i> ⁵	108 Hs <i>7s</i> ² <i>6d</i> ⁶	109 Mt <i>7s</i> ² <i>6d</i> ⁷	110 Ds <i>7s</i> ² <i>6d</i> ⁸	111 Rg <i>7s</i> ² <i>6d</i> ⁹	112 <i>7s</i> ² <i>6d</i> ¹⁰		114 <i>7s</i> ² <i>7p</i> ²		116 <i>7s</i> ² <i>7p</i> ⁴		
Inner Transition Elements (<i>f</i> block)																		
6	*Lanthanides	58 Ce <i>6s</i> ² <i>4f</i> ¹ <i>5d</i> ¹	59 Pr <i>6s</i> ² <i>4f</i> ³	60 Nd <i>6s</i> ² <i>4f</i> ⁴	61 Pm <i>6s</i> ² <i>4f</i> ⁵	62 Sm <i>6s</i> ² <i>4f</i> ⁶	63 Eu <i>6s</i> ² <i>4f</i> ⁷	64 Gd <i>6s</i> ² <i>4f</i> ⁷ <i>5d</i> ¹	65 Tb <i>6s</i> ² <i>4f</i> ⁹	66 Dy <i>6s</i> ² <i>4f</i> ¹⁰	67 Ho <i>6s</i> ² <i>4f</i> ¹¹	68 Er <i>6s</i> ² <i>4f</i> ¹²	69 Tm <i>6s</i> ² <i>4f</i> ¹³	70 Yb <i>6s</i> ² <i>4f</i> ¹⁴	71 Lu <i>6s</i> ² <i>4f</i> ¹⁴ <i>5d</i> ¹			
7	**Actinides	90 Th <i>7s</i> ² <i>6d</i> ²	91 Pa <i>7s</i> ² <i>5f</i> ² <i>6d</i> ¹	92 U <i>7s</i> ² <i>5f</i> ³ <i>6d</i> ¹	93 Np <i>7s</i> ² <i>5f</i> ⁴ <i>6d</i> ¹	94 Pu <i>7s</i> ² <i>5f</i> ⁶	95 Am <i>7s</i> ² <i>5f</i> ⁷	96 Cm <i>7s</i> ² <i>5f</i> ⁷ <i>6d</i> ¹	97 Bk <i>7s</i> ² <i>5f</i> ⁹	98 Cf <i>7s</i> ² <i>5f</i> ¹⁰	99 Es <i>7s</i> ² <i>5f</i> ¹¹	100 Fm <i>7s</i> ² <i>5f</i> ¹²	101 Md <i>7s</i> ² <i>5f</i> ¹³	102 No <i>7s</i> ² <i>5f</i> ¹⁴	103 Lr <i>7s</i> ² <i>5f</i> ¹⁴ <i>6d</i> ¹			

Measurement

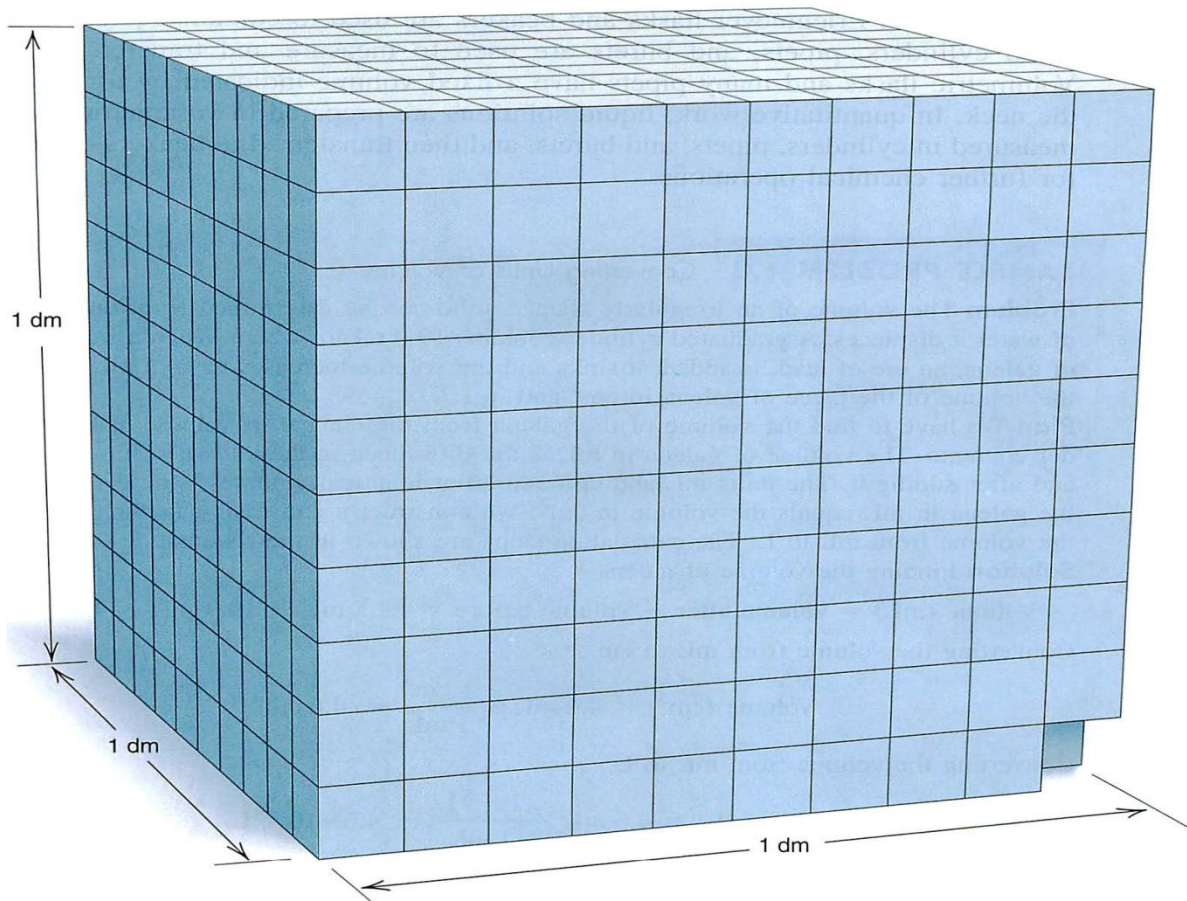


Figure 1.6 Some volume relationships in SI. The cube on the left is 1 dm³. Each edge is 1 dm long and is divided into ten 1-cm segments. One of those segments forms an edge of the middle cube, which is 1 cm³, and is divided into ten 1-mm segments. Each one of those segments forms an edge of the right cube, which is 1 mm³.

Some volume equivalents:

$$1 \text{ m}^3 = 1000 \text{ dm}^3$$

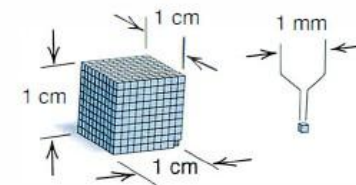
$$1 \text{ dm}^3 = 1000 \text{ cm}^3$$

$$= 1 \text{ L} = 1000 \text{ mL}$$

$$1 \text{ cm}^3 = 1000 \text{ mm}^3$$

$$= 1 \text{ mL} = 1000 \mu\text{L}$$

$$1 \text{ mm}^3 = 1 \mu\text{L}$$



Quick Question: At what temperature, Fahrenheit equals to Celsius?

Table 1.3 Common SI-English Equivalent Quantities

Quantity	SI	SI Equivalents	English Equivalents	English to SI Equivalent
Length	1 kilometer (km)	1000 (10^3) meters	0.6214 mile (mi)	1 mile = 1.609 km
	1 meter (m)	100 (10^2) centimeters	1.094 yards (yd)	1 yard = 0.9144 m
		1000 millimeters (mm)	39.37 inches (in)	1 foot (ft) = 0.3048 m
	1 centimeter (cm)	0.01 (10^{-2}) meter	0.3937 inch	1 inch = 2.54 cm (exactly)
Volume	1 cubic meter (m^3)	1,000,000 (10^6) cubic centimeters	35.31 cubic feet (ft^3)	1 cubic foot = 0.02832 m^3
	1 cubic decimeter (dm^3)	1000 cubic centimeters	0.2642 gallon (gal) 1.057 quarts (qt)	1 gallon = 3.785 dm^3 1 quart = 0.9464 dm^3
				1 quart = 946.4 cm^3
	1 cubic centimeter (cm^3)	0.001 dm^3	0.03381 fluid ounce	1 fluid ounce = 29.57 cm^3
Mass	1 kilogram (kg)	1000 grams	2.205 pounds (lb)	1 pound = 0.4536 kg
	1 gram (g)	1000 milligrams (mg)	0.03527 ounce (oz)	1 ounce = 28.35 g

Nomenclature

	Prefix	Root	Suffix
No. of O atoms ↑	per	<i>root</i>	ate
		<i>root</i>	ate
		<i>root</i>	ite
	hypo	<i>root</i>	ite

Figure 2.17 Naming oxoanions. Prefixes and suffixes indicate the number of O atoms in the anion.

Table 2.6 Numerical Prefixes for Hydrates and Binary Covalent Compounds

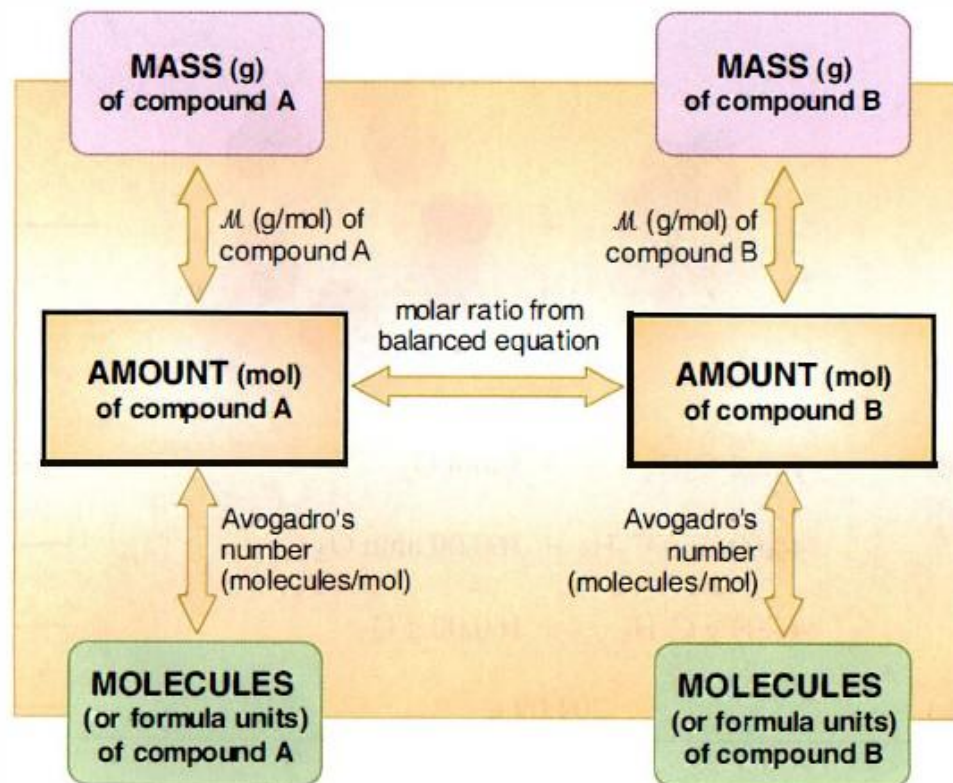
Number	Prefix
1	mono-
2	di-
3	tri-
4	tetra-
5	penta-
6	hexa-
7	hepta-
8	octa-
9	nona-
10	deca-

Molecular Weight \mathcal{M} , Mole (Mol) and Avogadro's Number

Figure 3.8 Summary of the mass-mole-number relationships in a chemical reaction. The amount of one substance in a reaction is related to that of any other. Quantities are expressed in terms of grams, moles, or number of entities (atoms, molecules, or formula units). Start at any box in the diagram (known) and move to any other box (unknown) by using the information on the arrows as conversion factors. As an example, if you know the mass (in g) of A and want to know the number of molecules of B, the path involves three calculation steps:

1. Grams of A to moles of A, using the molar mass (\mathcal{M}) of A
2. Moles of A to moles of B, using the molar ratio from the balanced equation
3. Moles of B to molecules of B, using Avogadro's number

Steps 1 and 3 refer to calculations discussed in Section 3.1 (see Figure 3.4).



Oxidation-Reduction Reaction (REDOX)

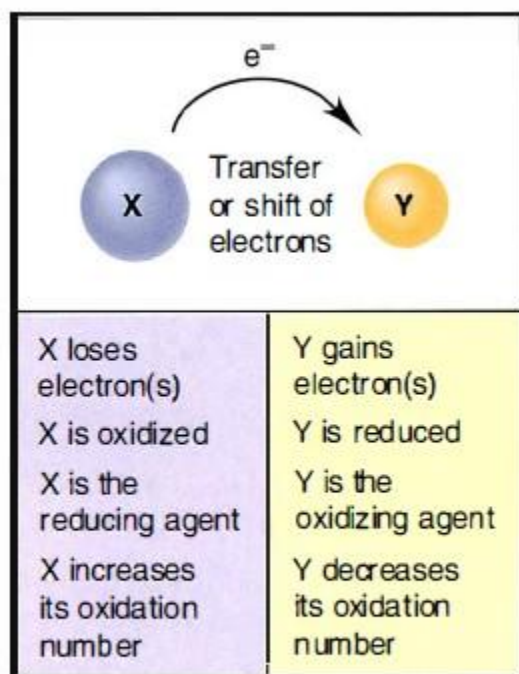


Figure 4.11 A summary of terminology for oxidation-reduction (redox) reactions.

Li	
K	
Ba	Can displace H ₂ from water
Ca	
Na	
Mg	
Al	
Mn	Can displace H ₂ from steam
Zn	
Cr	
Fe	
Cd	
Co	
Ni	Can displace H ₂ from acid
Sn	
Pb	
H ₂	
Cu	
Hg	Cannot displace H ₂ from any source
Ag	
Au	

Figure 4.14 The activity series of the metals. This list of metals (and H₂) is arranged with the most active metal (strongest reducing agent) at the top and the least active metal (weakest reducing agent) at the bottom. The four metals below H₂ cannot displace it from any source.

EN Pauling Scale

